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Sources of Income Inequality in Rural Pakistan

A Decomposition Analysis

Richard H. Adams, Jr.
and
Harold Alderman

That some people own more land than others is not the main source of agricultural income inequality in rural Pakistan. That some people receive higher profits and returns to labor on their cultivation than do others is. Reducing inequality might require providing more training in managerial and technical skills.

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This paper — a product of the Agricultural Policies Division, Agriculture and Rural Development Department — is part of a larger effort in the Department to monitor the impact of agricultural policies on poverty. Copies of this paper are available free from the World Bank, 1818 H Street NW, Washington DC 20433. Please contact Cicely Spooner, room N8-039, extension 30464 (34 pages). January 1992.

Using panel data from a three-year study of 727 households, Adams and Alderman identify the sources of income inequality in rural Pakistan.

First, they decompose total rural income among five sources: agricultural, livestock, rental, nonfarm, and transfer income. This decomposition shows that agricultural income contributes most to inequality in total rural income.

Next, they decompose the sources of inequality in agricultural income. This leads to the surprising finding that inequitable ownership of land is *not* the main source of inequality in agricultural income. Income from returns to labor and crop profits contribute most to this area of inequality.

One way to reduce rural income inequality might be to find more ways to narrow the disparities between abilities, perhaps by teaching more managerial and technical skills to agriculturists.

According to Adams and Alderman, policy-...akers concerned about inequality in rural Pakistan would also be well advised to pay more attention to livestock. Income from livestock apparently decreases the inequalities in income.

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Sources of Income Inequality in Rural Pakistan: A Decomposition Analysis

by
Richard H. Adams, Jr.
International Food Policy Research Institute

and

Harold Alderman
World Bank (AGRAP)

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Ever since the appearance of Kuznets' seminal works (1955, 1963) on the relationship between economic development and income inequality, there has been much interest and speculation about the sources of income inequality in the developing world. Within the past fifteen years the development of new methodologies for decomposing the sources of income inequality has infused this subject area with new data and insights. Using various techniques, a number of empirical studies in individual developing countries have pinpointed the contribution of different sources of income to total income inequality.[1] These studies have decomposed income inequality by economic sector (e.g., urban vs. rural), income source (e.g., income from labor vs. capital vs. land) and family characteristics (including educational and occupational attributes of workers).

Such empirical studies are of considerable potential use to developing country policymakers because they help identify both the structure of income inequality and how the character of that inequality changes over time. Equipped with such information, government officials can devise specific policy measures to help improve the distribution of urban and rural incomes.

This paper seeks to add to our knowledge about the sources of income inequality in the developing world by examining the sources of such inequality in rural Pakistan. The paper seeks to make two contributions. First, it uses panel data gathered in a rural area to identify the contribution of different sources of income --

agricultural, livestock, rental, non-farm and transfer -- to total rural income inequality. This is useful because, to date, few decomposition studies have used time-series data in ungrouped (disaggregated) form to show how the contribution of various income sources to rural inequality in a developing country fluctuates over time.[2] Second, after identifying agricultural income as the main source of rural income inequality, this study decomposes the sources of agricultural income with a view to understanding how much of this agricultural inequality is due to unequal landownership. Rather surprisingly, this analysis shows that while landownership is highly skewed in rural Pakistan, unequal landownership does not represent the main source of agricultural income inequality in rural Pakistan. According to this study, the main source of agricultural inequality is income from returns to labor and crop profit.

The paper proceeds in five sections. Section 1 examines the measurement of income inequality and presents the decomposition of several inequality measures. Section 2 presents the data set from rural Pakistan. Section 3 then analyzes changes in the sources of income inequality rural Pakistan over three years, 1986-1989. In this section agricultural income is identified as the leading source of income inequality in rural Pakistan. Section 4 therefore decomposes the sources of agricultural income inequality. Section 5 presents the conclusions of the study.

1. The Decomposition of Income Inequality

At the start of any decomposition exercise, the question arises: what measure of inequality should be chosen for the analysis? A number of different inequality measures have been proposed in the literature (Fields, 1980; Kakwani, 1980). Following Foster (1985) and others, the chosen measure should have five basic properties. They are: (1) Pigou-Dalton transfer sensitivity; (2) symmetry; (3) mean independence; (4) population homogeneity; (5) decomposability.

Pigou-Dalton transfer sensitivity holds if the measure of inequality increases whenever income is transferred from one person to someone richer. Symmetry holds if the measure of inequality remains unchanged when individuals switch places in the income order. Mean independence holds if a proportionate change in all incomes leaves the measure of inequality unchanged. Population homogeneity holds if increasing (or decreasing) the population size across all income levels has no effect on the measured level of inequality.

Decomposability, for the purposes of this analysis, refers to source decomposability. Ideally, one would expect that an inequality measure is source decomposable if total inequality can be broken down into a weighted sum of inequality by various income sources (e.g. agricultural and non-agricultural income). However, this is not possible if there is covariance among the sources of income. Thus, no inequality measure is source decomposable if it cannot deal with covariance among the income sources.

There are several measures of inequality which meet these five properties. These measures include Theil's entropy index T, Theil's second measure L, the coefficient of variation and the Gini

coefficient.[3] However, while the two Theil measures meet all the desirable properties, they are not decomposable when sources of income are overlapping and not disjoint. Since the households in this study typically receive income from several different sources, the two Theil measures cannot be used.

Shorrocks (1982) has shown that the results of decomposing any inequality measure depend on the rule used in the decomposition procedure. In the absence of any restrictions, for any inequality measure the inequality of total income can be allocated in many ways between the components of total income (Shorrocks, 1982: 199). For this reason, it seems best to base the decomposition analysis on the two remaining inequality measures: the coefficient of variation and the Gini coefficient. Although these two inequality measures are decomposable for any number of income sources, this study will divide income into five sources: agricultural, livestock, rental, non-farm and transfer. Unlike other decomposition studies which are based on a more limited number of income sources (e.g. Glewwe, 1986), such a division provides more detail for understanding the various components of income inequality.

The source decomposition based on the coefficient of variation can be developed following Shorrocks (1982) and Ercelawn (1984). Let total income, y, consist of income from k sources. The variance of total income, σ^2, can be written as the sum of variances of each source of income, σ_i^2, and of the covariances between sources of income, σ_{ij}:

$$\sigma^2 = \Sigma_i \sigma_i^2 + \Sigma_{i \neq j} \sigma_{ij} \qquad (1)$$

The contribution of the i-th source of income to total income variance consists of the i-th income variance and the part of the covariances allocated to the i-th source. According to Shorrocks (1982), the "natural" decomposition of the variance assigns to the i-th source exactly one-half of all covariances involving the i-th income source. This leads to the expression:

$$\sigma^2 = \Sigma\sigma_{iy} \qquad (2)$$

where the (absolute) contribution of the i-th source is measured by its covariance with total income, y. This relationship can be rewritten so as to express the contribution in relative terms. As is apparent, the relative contributions remain the same whether inequality is measured by the variance or by the coefficient of variation. Since the variance does not meet the axiom of mean independence (i.e. it is not invariant to proportional changes in all incomes) the coefficient of variation will be adopted here. The decomposition corresponding to the coefficient of variation can be further elucidated by defining the following terms:

$$\sum w_i c_i = 1;\ w_i = \frac{\mu_i}{\mu};\ c_i = \rho_i \frac{\sigma_i/\mu_i}{\sigma/\mu} \qquad (3)$$

where $w_i c_i$ is the so-called "factor inequality weight" of the i-th source in overall inequality; μ_i and μ are the mean income from the i-th source and from all sources, respectively; c_i is the relative concentration coefficient of the i-th source in overall inequality;

and ρ_i is the correlation coefficient between the i-th source and total income.

The decomposition of the Gini coefficient can be developed as follows. Pyatt et al. (1980) have shown that the Gini coefficient of total income, G, can be written as:

$$G = \frac{2}{n\mu} \text{ Cov } (y,r) \tag{4}$$

where n is the number of observations, y refers to the series of total incomes and r refers to the series of corresponding ranks. On this basis the Gini coefficient of the i-th source of income, G_i, can be expressed as:

$$G_i = \frac{2}{n\mu_i} \text{ Cov } (y_i, r_i) \tag{5}$$

where y_i and r_i refers to the series of incomes from the i-th source and corresponding ranks, respectively. Since total income is the sum of source incomes, the covariance between total income and its rank can be written as the sum of covariances between each source income and rank of total income. Equations (4) and (5) can then be used to express the total income Gini as a function of the source Ginis:

$$G = \Sigma \frac{\mu_i}{\mu} R_i G_i \tag{6}$$

where R is the "correlation ratio" expressed as:

$$R_i = \frac{\text{cov}(y_i,r)}{\text{cov}(y_i,r_i)} = \frac{\text{covariance between source income amount and total income rank}}{\text{covariance between source income amount and source income rank}} \tag{7}$$

The decomposition corresponding to the Gini coefficient can then be expressed by defining the following terms:

$$\Sigma w_i g_i = 1;\ w_i = \frac{\mu_i}{\mu};\ g_i = R_i \frac{G_i}{G} \qquad (8)$$

where $w_i g_i$ is the "factor inequality weight" of the i-th source in overall inequality; and g_i is the relative concentration coefficient of the i-th source in overall inequality.

As noted by Lerman and Yitzhaki (1985), the Gini correlation ratio (R) in equation (7) has properties similar to the Pearson correlation. Like Pearson's, the Gini correlation ranges between -1 and +1. R will equal 1 (-1) when an income source is an increasing (decreasing) function of total income. When the income source is a constant, then R will equal 0, implying that the source's share of the Gini is 0.

2. Data Set

Data come from a three-year survey of 734 households in three provinces in rural Pakistan.[4] Since the goal of this survey was to analyze the determinants of rural poverty, the survey was not designed to be representative of the rural population as a whole in Pakistan. In each province the poorest district was selected on the basis of a production and infrastructure index elaborated by Pasha and Hasan (1982). The selected districts included Attock (Punjab province), Badin (Sind province) and Dir (Northwest Frontier province). Since rural poverty also exists in relatively prosperous areas, a fourth district Faisalabad (Punjab province) was added to the survey.[5]

Surveying of the households continued over a three-year period, 1986-87, 1987-88 and 1988-89. Of the total 734 households, 7

households were excluded because of missing or incomplete data. The analysis is therefore based on data from 727 households.[6]

As noted above, total income for each household was divided into five sources:

(1) Agricultural - Includes net income in agriculture plus return to own agricultural labor;

(2) Non-farm - Includes non-farm wage earnings and profits from non-farm enterprises;

(3) Livestock - Includes net returns from livestock (cattle, poultry);

(4) Rental income - Includes rents received from ownership of assets (land, machinery, water)

(5) Transfer - Includes remittances from abroad, internal remittances, pensions (government) and zakat (payments to poor).

Table 1 presents summary data for the five income sources over the three survey years. The data show that non-farm income represents the most important source of mean per capita household income in all three years. Agricultural income represents the second most important source of income. The importance of the other three income sources -- transfer, livestock and rental -- varies by year.

As calculated from Table 1, the Gini coefficient of inequality of per capita household income for the sample increased slightly over the period of the survey: from 0.384 in 1986-87 to 0.408 in 1987-88 to 0.417 in 1988-89. These Gini coefficients suggest that the distribution of income in the rural survey sites is roughly similar to that recorded for other Asian countries.[7]

In Table 2 the five sources of income are presented by income quintile group. The results underscore those of other studies[8] in pinpointing the importance of non-farm income for poor households. According to the data, households in the lowest income quintile group receive over 40 percent of their mean per capita income from non-farm activities. The second most important source of income for poor households is livestock income. By means of contrast, households in the highest income quintile receive the bulk of their mean per capita income from agricultural and rental income.

3. Income Inequality in Rural Pakistan, 1986-1989

Decomposing the coefficient of variation and the Gini coefficient provides two ways for measuring the contribution of any income source to overall income inequality. First, it can be asked whether inequality in an income source serves to increase or decrease overall income inequality. Second, it is possible to identify how much of the overall inequality is due to any particular income source.

An income source can be defined as inequality-increasing or inequality-decreasing on the basis of whether or not an enlarged share of that income source leads to an increase or decrease in overall income inequality. From the decomposition equations (3) and (8), it follows that the i-th income source is inequality-increasing or inequality-decreasing according to whether c_i (or g_i) is greater than or less than unity.[9]

Table 3 reports the decomposition results with respect to the distinction between inequality-increasing versus inequality-decreasing

for the five sources of income: (1) agricultural; (2) livestock; (3) rental; (4) non-farm; and (5) transfer.

In Table 3 both decompositions agree that for all three years two income sources -- agricultural and rental -- represent inequality-increasing sources of income. Similarly, both decompositions agree that for all three years one source of income -- non-farm -- represents an inequality-decreasing source of income. However, for two income sources -- transfer and livestock -- the alternative decompositions give different results for various years.[10] For two of three years both decompositions agree that transfer income represents an inequality-increasing source of income; but for one of the years the coefficient of variation suggests the opposite. Similarly, for two of the three years both decompositions agree that livestock income is an inequality-decreasing source of income; but for one of the years the coefficient of variation suggests the opposite.

Table 4 presents the decomposition results for relative factor inequality weights of source incomes in overall income inequality. Four items deserve mention here. First, all of the Gini decompositions and two of the three coefficient of variation decompositions agree that agricultural income makes the largest contribution to overall inequality. Depending on the year, the two decompositions suggest that agricultural income accounts for between 26.9 and 42.2 percent of overall inequality. Second, all of the Gini decompositions and two of the three coefficient of variation decompositions agree that livestock income makes the smallest contribution to overall inequality. Depending on the year, the two decompositions suggest that livestock income accounts for between 0.2

and 16.2 percent of overall income inequality. Third, the results of Table 4 suggest that the contributions of other income sources to overall inequality vary widely depending on the index used to measure inequality. Consider, for example, the contribution of transfer income. In one single year (1986-87) the contribution of transfer income to overall inequality varies from 22.6 percent (using the Gini decomposition) to 28.5 percent (using the coefficient of variation decomposition). These results tend to corroborate Shorrocks' finding (1983) that factor inequality weights for any income source can vary widely depending on the index used to decompose inequality. Fourth, the results of Table 4 show appreciable changes in the contributions of various income sources to overall inequality between years. For example, as measured by the Gini coefficient the contribution of rental income to overall inequality increases by 27.4 percent between 1987-88 and 1988-89. Using the same index, between 1987-88 and 1988-89 the contribution of transfer income to overall inequality declines by 102 percent.

The results of Table 4 can be further explained by analyzing the results of the Gini decomposition. This is done in Table 5, which presents the three elements of the Gini decomposition procedure: (1) source income weight; (2) source gini; and (3) correlation ratio between source income and total income inequality.

Row (1) of Table 5 shows that non-farm income constitutes the most important source of income for all three years, accounting for between 29.8 and 32.8 percent of all income. Agricultural income represents the second most important source of income for all three years, accounting for between 29.8 and 31.6 percent of all income.

The importance of the other sources of income varies by year, with rental income representing the least important source of income for two of the three years.

Row (2) of Table 5 shows that rental income has the highest source gini for all three years and is thus the least equally distributed income source. This is a reflection of the fact that -- depending on the year -- only 29.8 to 34.3 percent of all 727 households receive rental income. By means of contrast, row (2) shows that non-farm income has the lowest source gini for two of three years and thus represents the most equally distributed source of income. Depending on the year between 74.4 and 76.7 percent of all 727 households receive non-farm income.

Row (3) of Table 5 reports the correlation ratios between source income and total income inequality. The figures show that inequality in rental income is highly correlated with overall income inequality. By comparison, the data show that inequality in non-farm and livestock income have a low degree of correlation with total income inequality.

The data in Table 5 serve to explain the factor inequality weights reported in the preceding table. For example, Table 4 shows that agricultural income has the highest factor inequality weight and makes the largest contribution to overall income inequality. This is because agricultural income has a large share of total income, a middle-sized source gini and is moderately correlated with overall income inequality. At the other extreme, Table 4 shows that livestock income makes the smallest contribution to overall income inequality. This is because livestock income has a middle-sized share

of total income, a low source gini and is poorly correlated with overall income inequality.

4. Sources of Agricultural Income Inequality in Rural Pakistan

The fact that agricultural income makes the largest contribution to overall income inequality makes it useful to decompose the sources of agricultural income inequality. Such an exercise is instructive because it can pinpoint the proportion of agricultural income inequality that comes from unequal landownership. In rural Pakistan land is distributed quite unevenly: in the survey sites the Gini coefficients of landownership and landholdings are 0.769 and 0.630, respectively.[11] In the past, a number of studies have suggested that such unequal land distribution represents a major determinant of rural income inequality in Pakistan and other developing countries.[12]

Two problems must be addressed before agricultural inequality can be decomposed in this study. First, in order to include all agricultural income in the decomposition procedure, the income categories used in this study must be revised. Most importantly, the income received from land rent that has heretofore been classified as part of "rental income" needs to be reclassified as part of "agricultural income." Under reasonable assumptions, owner cultivation using hired labor and tenancy will have similar levels of production and profits. However, if "rental income" is not reclassified as part of "agricultural income," these two alternative uses would have very different implications for income distribution in agriculture. Second, it is useful to distinguish the rent notionally paid by the landowning household to itself from returns to labor and

crop profit. The best way to do this is to calculate imputed land rents.

Imputed land rents in this data set can be determined using the following procedure. For the two districts (Faisalabad and Badin) which have only irrigated land, it is necessary to determine median annual land rents per acre (for land rented out) in each district. For the two districts (Attock and Dir) which have both irrigated and rainfed land, average annual land rents per acre (for land rented out) can be determined using the following regression:

$$TOTRENT_{hi} = f(ACIRR_{hi}, ACRAIN_{hi}), \quad (9)$$

where TOTRENT = Total value of land rent received by household h in district i

ACIRR = Total acres of irrigated land rented out by household h in district i

ACRAIN = Total acres of rainfed land rented out by household h in district i

Equation (9) was run separately for each district with irrigated and rainfed land (Attock and Dir). In this equation the regression coefficients for the independent variables (ACIRR and ACRAIN) represent the average annual land rents per acre for irrigated and rainfed land, respectively.

For each year of the survey total annual imputed land rent can then be calculated as the product of household values for two terms: average annual land rent per acre[13] and the number of acres cultivated.[14]

Once imputed land rent is calculated, total agricultural income in the study can be divided into four sources:

(1) Imputed land rent

(2) Land rent - Includes rent received for the leasing of land;

(3) Agricultural wages - Includes payments in wages and kind for agricultural work;

(4) Other income - Includes returns to labor and crop profit.

Table 6 presents summary data for the four sources of agricultural income over the three survey years. The data show that other agricultural income (returns to labor and crop profit) represents the most important source of mean per capita agricultural income in all three years. By contrast, it is interesting to note the relative unimportance of agricultural wages: agricultural wages represent less than 4 percent of total mean per capita agricultural income in any given year. In the sample area the widespread sharing of agricultural labor between and among families apparently serves as a substitute for the hiring of wage labor.[15]

Table 7 reports the decomposition results with respect to the distinction between inequality-increasing and inequality-decreasing sources of agricultural income. With only one exception in each case, both decompositions agree that two income sources -- land rent and other agricultural income (returns to labor and crop profit) -- represent inequality-increasing sources of agricultural income. Both decompositions also agree that two income sources -- imputed land rent and agricultural wages -- represent inequality-decreasing sources of agricultural income. Given the widespread belief that landownership -- here measured in terms of imputed land rent -- represents an inequality-increasing source of income, these results are surprising and will be examined below.

Table 8 presents the decomposition results for relative factor inequality weights of source incomes in agricultural inequality. Again the results suggest that unequal landownership does not represent a major source of agricultural income inequality. This may be seen in two ways. First, both decompositions agree that for all three years other agricultural income (returns to labor and crop profit) makes the largest contribution to agricultural income inequality. According to the data, other agricultural income accounts for between 42.6 and 68.4 percent of agricultural income inequality. Second, with only one exception both decompositions agree that for all three years landownership -- here measured by combining imputed land rent and land rent -- makes a smaller contribution than other agricultural income (returns to labor and crop profit) to agricultural inequality. Combining the factor inequality weights for imputed land rent and land rent together, the data suggests that landownership accounts for between 31.6 and 57.0 percent of agricultural income inequality. Given the common view that unequal landownership plays a dominant role in rural income inequality, these results require elaboration.

The results in Table 8 can be explained by presenting the three elements of the Gini decomposition: (1) source income weight; (2) source gini; and (3) correlation ratio between source income and total income inequality. This is done in Table 9.

According to row (2) of Table 9, other agricultural income (returns to labor and crop profit) has the highest source gini in two of the three years. In fact, in two years the ginis for this income source exceed 1.0.[16] By contrast, the other sources of agricultural

income are distributed more equally. Row (3) of Table 9 shows that the correlation ratio between source income and total income inequality is highest for two income sources: land rent and other agricultural income. By contrast, inequality in imputed land rent is poorly correlated with total income inequality and inequality in agricultural wages is very weakly correlated with total agricultural income inequality.

The data in Table 9 serve to explain why unequal landownership does not play a dominant role in agricultural income inequality in this sample. While the source income weights for landownership -- measured by combining the values for imputed land rent and land rent -- generally exceed those for other agricultural income, the source ginis and correlation ratios for these two income sources are on the whole less than those for other agricultural income. In this sample other agricultural income (returns to labor and crop profit) represents the main source of agricultural income inequality. This is because other agricultural income (returns to labor and crop profit) has a large share of total agricultural income, a large source gini and is highly correlated with total agricultural inequality.

5. Conclusion

This paper has examined the sources of income inequality in rural Pakistan. Using three-year time series data from 727 households in three provinces, this study decomposed both the sources of overall income inequality and the sources of agricultural income inequality.

Two central findings emerge from the paper. First, the study shows that of the five sources of total rural income -- agricultural,

livestock, rental, non-farm, and transfer -- agricultural income makes the largest contribution to overall income inequality. This is because agricultural income has a large share of total income, a middle-sized source gini and is moderately correlated with overall income inequality. At the other extreme, the study shows that livestock income makes the smallest contribution to overall income inequality. This latter finding suggests an important policy conclusion, namely, that policymakers who are concerned with income inequality in rural Pakistan would be well-advised to pay more attention to livestock. According to this study, livestock income represents an inequality-decreasing source of income because it has a middle-sized share of total income, a low source gini and is poorly correlated with overall income inequality.

Second, this study decomposes the sources of agricultural income inequality in order to understand how much of this inequality is caused by unequal landownership. In the study area landownership and landholdings are quite skewed; both are distributed far more unequally than income.[17] However, rather surprisingly, the study shows that unequal landownership -- as measured by imputed land rent and land rent -- does not represent the main source of agricultural income inequality. According to the study, the main source of agricultural income inequality is other agricultural income (returns to labor and crop profit). According to the data, other agricultural income accounts for between 43 and 52 percent of agricultural income inequality.

It is important to realize that this finding concerning the relative unimportance of landownership in determining agricultural

income inequality is consistent with the results of other studies. Using similar methodologies, other studies of the sources of income inequality in Taiwan, Pakistan and Colombia have found that the bulk of such inequality comes from labor -- and not property or land -- income.[18] On the basis of these studies, Fields (1980: 114) concludes:

> The bulk of income inequality is attributable to labor income. (According to these studies) the principal inequality-producing factor is that some people receive a great deal more income for their work than do others. . . The intuitive prior notion that the most unequally distributed factors (such as property) contribute the most to total inequality is found to be false. . . .

In this study it was impossible to decompose other agricultural income (returns to labor and crop profit) in order to identify the contribution of labor income -- as opposed to crop income -- to agricultural inequality. Nevertheless, the study's finding that returns to labor and crop profit represent the main source of agricultural income inequality has important implications for policymaking. Most basically, it suggests that increased attention needs to be paid to the techniques and technologies of crop production in Pakistan. If the goal is to reduce income inequalities in rural Pakistan, researchers and policymakers need to find ways to narrow the disparities in human capital (including managerial and technical skills) between different agriculturalists.

Notes

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1. On Pakistan, see Kruijk (1987), Mohammad and Badar (1985) and Ercelawn (1984); on other developing countries, see Glewwe (1986), Nugent and Walther (1982) and Pyatt, Chen and Fei (1980).

2. Among the decomposition studies cited in note (1), only Nugent and Walther (1982) use panel data in ungrouped (disaggregated) form to examine short-run fluctuations in the sources of rural income inequality.

3. For an overview of these four inequality measures, see Anand (1983: 89-91).

4. This study was undertaken by the International Food Policy Research Institute (IFPRI) working in collaboration with Pakistani research institutes -- Applied Economic Research Centre (University of Karachi), Punjab Economic Research Institute (Lahore), the University of Baluchistan (Quetta) and the Center for Applied Economic Studies (University of Peshawar).

5. The sample was randomly drawn with all rural residents in the selected districts having an equal probability of being included. Landowners who reside in urban areas, therefore, are not included in the sample. Since unweighted samples generally tend to miss the apex of a distribution, the fact that there are, for example, far fewer households owning 3,000 acres of land than there are households owing 3 acres may lead to a slight underrepresentation of the skew of landholding in any moderately sized sample.

6. The 727 households were distributed among the districts as follows: 148 from Attock District (Punjab), 239 from Badin District (Sind), 193 from Dir District (Northwest Frontier) and 147 from Faisalabad District (Punjab).

7. The Gini coefficients of household income recorded for ten Asian countries in Lecaillon et. al (1984: Table 3) range from a low of 0.351 (Korea) to a high of 0.561 (Iran). It should, however, be noted

that the Gini coefficients for these Asian countries are based on the distribution of overall (i.e. rural and urban), while the Ginis used in this study are based on rural household income. In theory, one would expect that the distribution of rural household income to be more egalitarian than that of overall household income. See Lecaillon et. al (1984: 67-68).

8. For Pakistan, see Klennert (1986); for other developing countries see von Braun and Pandya-Lorch (1991).

9. This analysis ignores feedback effects, that is, the effects that a change in any source income share might have on distribution within any source income. Of course, such an assumption might be quite unrealistic for large changes in any source income share.

10. As Ercelawn (1984: 7) has shown, this contradiction occurs either when $c_i < 1$ and $g_i \geq 1$ or when $c_i \geq 1$ and $g_i < 1$. The contradiction seems to reflect the greater sensitivity of the Gini to middle-income groups and of the coefficient of variation to extreme incomes.

11. Both of these Gini calculations include households with no land. Landownership and landholdings do not include waste land. Landholdings include land owned plus land rented in minus land rented out.

For households with land in the sample, mean landownership is 11.44 acres with a standard deviation of 18.19; mean landholdings is 9.70 acres with a standard deviation of 12.15.

12. For Pakistan, see Ercelawn (1984) and Naqvi, Khan and Chaudhry (1989). For other developing countries, see Quan (1989) and Bardhan (1984).

13. Using the procedures outlined in the text, average annual land rents per acre varied (low to high) as follows: Faisalabad District (Punjab), from 1234.3 rupees in 1988-89 to 1528.8 rupees in 1986-87; rainfed areas of Attock District (Punjab), from 10.2 rupees in 1986-87 to 117.2 rupees in 1987-88; irrigated areas of Attock, from 366.3 rupees in 1987-88 to 540.4 rupees in 1988-89; Badin District (Sind), from 874.2 rupees in 1988-89 to 904.1 rupees in 1987-88; rainfed areas of Dir District (Northwest Frontier), from 144.3 in 1986-87 to 815.9 rupees in 1988-89; and irrigated areas of Dir District, from 177.1 rupees in 1986-87 to 978.5 rupees in 1988-89. In all districts the variability in rental prices reflects, in part, the fact that most rental agreements are for sharecropping rather than fixed rents. All rental prices are in constant 1986 rupees.

14. For each household, number of acres cultivated equals land owned minus land rented out. In all districts except Badin, land rental area is based on area rented out in rabi (winter) season. For Badin District land rental area is based on area rented out in kharif (monsoon) season.

15. For a discussion of this point, see Nabi et. al (1986).

16. For an explanation of this outcome, see note (a) in Table 9.

17. As noted in the text, the Gini coefficients of landownership and landholdings in the study area are 0.769 and 0.630, respectively. In contrast, the Gini coefficients of per capita household income range (according to year) from 0.384 to 0.417.

18. On Taiwan, see Fei, Ranis and Kuo (1978); on Pakistan, see Ayub (1977) and Kruijk (1987); and on Colombia, see Fields (1979).

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Table 1 -- Summary of Income Data from 1986 87, 1987-88 and 1988-89 Surveys in Rural Pakistan

Source of Income	1986-87 Mean Annual Per Capita Household Income[a/] in Rupees[b/]	1986-87 Standard Deviation	1987-88 Mean Annual Per Capita Household Income[a/] in Rupees[b/]	1987-88 Standard Deviation	1988-89 Mean Annual Per Capita Household Income[a/] in Rupees[b/]	1988-89 Standard Deviation
Non-farm	1028.75	1271.98	1142.97	1283.92	921.54	1009.31
Agricultural	831.38	1997.31	862.14	1632.01	885.35	2377.22
Transfer	596.82	1592.44	525.29	1461.70	242.91	812.57
Livestock	587.69	726.39	541.82	787.69	421.81	685.24
Rental	408.49	1556.63	412.43	1366.50	446.86	1500.70
Total	3453.12	3186.68	3484.65	3009.24	2918.47	3320.57

N = 727 households

Notes: (a) Mean income figures include negative source incomes recorded for some households in various years.
(b) In 1986, 1 Pakistani Rupee = US$0.062. All rupee figures in constant 1986 terms.

Table 2 -- Sources of Income by Mean Annual Per Capita Household Income Quintile Group

Income Quintile Group	Mean Annual Per Capita Household Income[a/] in Rupees[b/]	Percent from Non-farm Income	Percent from Agricultural Income	Percent from Transfer Income	Percent from Livestock Income	Percent from Rental Income
Lowest 20%	1231.94	40.8	20.6	11.1	23.2	4.3
Second 20%	1971.29	43.5	22.2	11.7	18.5	4.1
Third 20%	2603.89	36.0	25.9	10.2	22.7	5.2
Fourth 20%	3540.92	40.4	23.6	13.2	16.5	6.3
Highest 20%	7051.29	20.1	29.6	16.6	10.8	22.9
Total	3279.87					

N = 727 households

Notes:

[a/] Mean income figures calculated by averaging household income over the three years (1986-87 to 1988-89) and then dividing by average household size.

[b/] In 1986, 1 Pakistani Rupee = US $0.062. All rupee figures in constant 1986 terms.

Table 3 - Decomposition of Inequality: Relative Concentration Coefficients of Source Incomes in Overall Inequality

	1986-87		1987-88		1988-89	
Source of Income	Coefficient of Variation[a]	Gini Coefficient[b]	Coefficient of Variation[a]	Gini Coefficient[b]	Coefficient of Variation[a]	Gini Coefficient[b]
Non-farm	0.199	0.703	0.182	0.595	0.204	0.664
Agricultural	1.377	1.118	1.235	1.121	1.390	1.214
Transfer	1.655	1.306	1.179	1.364	0.692	1.222
Livestock	0.183	0.521	1.039	0.871	0.017	0.614
Rental	2.463	1.792	2.557	1.697	2.995	1.665
N = 727 households						

Notes:

All estimates based on annual per capita household income expressed in constant 1986 terms.

[a]Concentration of coefficient of inequality: $c_i = \rho_i \frac{\sigma_i/\mu_i}{\sigma/\mu}$

[b]Concentration of Gini coefficient: $g_i = R_i \frac{G_i}{G}$

Table 4 -- Decomposition of Inequality: Factor Inequality Weights of Source Incomes in Overall Inequality

1986 - 87				1987 - 88				1988 - 89			
Source of Income	Coefficient of Variation[a/]	Source of Income	Gini Coefficient[b/]	Source of Income	Coefficient of Variation[a/]	Source of Income	Gini Coefficient[b/]	Source of Income	Coefficient of Variation[a/]	Source of Income	Gini Coefficient[b/]
Agricultural	0.332	Agricultural	0.269	Agricultural	0.305	Agricultural	0.277	Rental	0.459	Agricultural	0.368
Rental	0.291	Transfer	0.226	Rental	0.298	Transfer	0.205	Agricultural	0.422	Rental	0.255
Transfer	0.285	Rental	0.211	Transfer	0.178	Rental	0.200	Non-farm	0.064	Non-farm	0.208
Non-farm	0.059	Non-farm	0.209	Livestock	0.162	Non-farm	0.194	Transfer	0.058	Transfer	0.101
Livestock	0.031	Livestock	0.085	Non-farm	0.060	Livestock	0.135	Livestock	0.002	Livestock	0.087
TOTAL	1.000		1.000		1.000		1.000		1.000		1.000
N = 727 households											

Notes:

All estimates based on annual per capita household income expressed in constant 1986 terms.

a/ Factor inequality weight for coefficient of variation: $w_i c_i$, where $w_i = \frac{\mu_i}{\mu}$, $c_i = \rho_i \frac{\sigma_i/\mu_i}{\sigma/\mu}$

b/ Factor inequality weight for Gini coefficient: $w_i g_i$, where $w_i = \frac{\mu_i}{\mu}$, $g_i = R_i \frac{G_i}{G}$

Table 5 -- Decomposition of Overall Income Inequality Using Gini Coefficient

	Year One, 1986-87		Year Two, 1987-88		Year Three, 1988-89	
Overall Gini Coefficient of Income	0.384		0.408		0.417	
	Source	Income Weight	Source	Income Weight	Source	Income Weight
(1) Source Income Weight	Non-farm	0.298	Non-farm	0.328	Non-farm	0.316
	Agric.	0.240	Agric.	0.247	Agric.	0.303
	Transfer	0.173	Livestock	0.155	Rental	0.153
	Livestock	0.170	Transfer	0.150	Livestock	0.145
	Rental	0.118	Rental	0.119	Transfer	0.083
		1.000		1.000		1.000
	Source	Source Gini	Source	Source Gini	Source	Source Gini
(2) Source Gini[a]	Rental	0.890	Rental	0.875	Rental	0.909
	Agric.	0.825	Transfer	0.867	Transfer	0.893
	Transfer	0.784	Agric.	0.785	Agric.	0.755
	Non-farm	0.599	Livestock	0.760	Livestock	0.747
	Livestock	0.578	Non-farm	0.583	Non-farm	0.563
(3) Correlation ratio between source and total inequality[b]	Correlation ratio between source and total inequality		Correlation ratio between source and total inequality		Correlation ratio between source and total inequality	
	Rental	0.773	Rental	0.792	Rental	0.763
	Transfer	0.639	Transfer	0.642	Agric.	0.668
	Agric.	0.520	Agric.	0.582	Transfer	0.570
	Non-farm	0.451	Livestock	0.467	Non-farm	0.491
	Livestock	0.346	Non-farm	0.416	Livestock	0.343

N = 727 households

Notes: All estimates based on annual per capita household income expressed in constant 1986 terms.

[a]Source Gini, $G_i = \frac{2}{n\mu_i} \text{cov}(y_i, r_i)$

[b]Correlation ratio between source and total inequality,

$$R_i = \frac{\text{cov}(y_i, r)}{\text{cov}(y_i, r_i)} = \frac{\text{covariance between source income amount and total income rank}}{\text{covariance between source income amount and source income rank}}$$

Table 6 -- Summary of Agricultural Income Data from 1986-87, 1987-88 and 1988-89 Surveys

Source of Income	1986-87 Mean Annual Per Capita Household Income in Rupees[a]	1986-87 Standard Deviation	1987-88 Mean Annual Per Capita Household Income in Rupees[a]	1987-88 Standard Deviation	1988-89 Mean Annual Per Capita Household Income in Rupees[a]	1988-89 Standard Deviation
Imputed Land Rent	325.81	937.83	317.43	951.79	286.89	816.14
Land Rent	281.82	1269.37	298.40	1076.65	317.47	1125.13
Agricultural Wages	32.34	132.19	46.29	209.52	30.55	94.93
Other (Returns to labor; crop profit)	488.16	1620.34	537.31	1263.47	639.65	2190.26
Total	1128.13	2439.15	1199.42	2064.42	1274.56	2772.99

Notes: Figures based on 680 households which represent those households from the original 727 households with positive agricultural incomes in any year of three survey years.

(a) All rupee figures in constant 1986 terms
(b) Total agricultural income figures in this table differ from those in Table 1 because "agricultural income" here includes land rent. In Table 1 land rent is included in "rental income," not "agricultural income." See text.

Table 7 -- Relative Concentration Coefficients of Source Incomes in Total Agricultural Income

	1986-87		1987-88		1988-89	
	Coefficient of Variation[a/]	Gini Coefficient[b/]	Coefficient of Variation[a/]	Gini Coefficient[b/]	Coefficient of Variation[a/]	Gini Coefficient[b/]
Imputed Land Rent	0.757	0.749	0.989	0.831	0.528	0.760
Land Rent	1.133	1.023	1.240	1.072	0.765	1.101
Agricultural Wages	-0.010	0.361	0.107	0.468	-0.013	0.112
Other (Returns to labor; crop profit)	1.155	1.197	0.950	1.106	1.334	1.048

Notes: Calculations based on 680 households which represent those households from the original 727 households with positive agricultural incomes in any year of three survey years.

All estimates based on annual per capita household income expressed in constant 1986 terms.

[a/]Concentration of coefficient of variation: $c_i = \rho_i \frac{\sigma i/\mu i}{\sigma/\mu}$

[b/]Concentration of Gini coefficient: $g_i = R_i \frac{G_i}{G}$

Table 8 -- Factor Inequality Weights of Source Incomes in Total Agricultural Income

	1986-87		1987-88		1988-89	
	Coefficient of Variation	Gini Coefficient	Coefficient of Variation	Gini Coefficient	Coefficient of Variation	Gini Coefficient
Imputed Land Rent	0.219	0.216	0.262	0.220	0.121	0.175
Land Rent	0.282	0.256	0.308	0.267	0.195	0.280
Agricultural Wages	0.001	0 010	0.004	0.018	0.001	0.008
Other (Returns to labor; crop profit)	0.500	0.518	0.426	0.495	0.684	0.537
TOTAL	1.000	1.000	1.000	1.000	1.000	1.000

Notes: Calculations based on 680 households which represent those households from the original 727 households with positive agricultural incomes in any year of three survey years.

All estimates based on annual per capita household income expressed in constant 1986 terms.

Table 9 - Decomposition of Agricultural Income Inequality Using Gini Coefficient

	1986-87		1987-88		1988-89	
(1) Source Income Weight	Source Income Weight		Source Income Weight		Source Income Weight	
	Imputed Land Rent	0.289	Imputed Land Rent	0.265	Imputed Land Rent	0.230
	Land Rent	0.250	Land Rent	0.249	Land Rent	0.253
	Agric Wages	0.029	Agric Wages	0.039	Agric Wages	0.024
	Other (Returns to labor; crop profit)	0.433	Other (Rents to labor; crop profit)	0.448	Other (Returns to labor, crop profit)	0.512
		1.000		1.000		1.000
(2) Source Gini[a/]	Source Gini		Source Gini		Source Gini	
	Imputed Land Rent	0.942	Imputed Land Rent	0.963	Imputed Land Rent	0.982
	Land Rent	0.926	Land Rent	0.919	Land Rent	0.910
	Agric Wages	0.928	Agric Wages	0.902	Agric Wages	0.903
	Other (Returns to labor; crop profit)	1.227	Other (Returns to labor; crop profit)	1.002	Other (Returns to labor; crop profit)	0.902
(3) Correlation ratio between source and total inequality[b/]	Correlation ratio between source and total inequality		Correlation ratio between source and total inequality		Correlation ratio between source and total inequality	
	Imputed Land Rent	0.589	Imputed Land Rent	0.612	Imputed Land Rent	0.527
	Land Rent	0.818	Land Rent	0.826	Land Rent	0.823
	Agric Wages	0.288	Agric Wages	0.367	Agric Wages	0.235
	Other (Returns to labor; crop profit)	0.722	Other (Returns to labor; crop profit)	0.782	Other (Returns to labor; crop profit)	0.775

Notes: Calculations based on 680 households which represent those households from the original 727 households with positive agricultural incomes in any year of the three survey years.

All estimates based on annual per capita household income expressed in constant 1986 terms.

[a/] Source Gini, $G_i = \frac{2}{n\mu_i} \text{cov}(y_i, r_i)$. Source Ginis can exceed unity if some of y_i are negative.

[b/] Correlation ratio between source and total inequality,

$$R_i = \frac{\text{cov}(y_i, r)}{\text{cov}(y_i, r_i)} = \frac{\text{covariance between source income amount and total income rank}}{\text{covariance between source income amount and source income rank}}$$

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